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Miniature lab can detect deadly bird flu virus in 30 minutes

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Researchers at the Institute of Bioengineering and Nanotechnology (IBN), Institute of Molecular and Cell Biology (IMCB) and Genome Institute of Singapore (GIS) have successfully developed a miniaturized device that can be used to detect the highly pathogenic avian flu (H5N1) virus.

If successfully commercialized, this device could be deployed in affected regions for pre-emptive surveillance of nascent avian flu epidemic.

According to project leader and lead author of the *Nature Medicine* publication, IBN Research Scientist Dr Juergen Pipper, "With our device, medical or humanitarian aid workers would be able to detect the presence of the H5N1 virus directly from throat swab samples on-site in less than half an hour."

With early warning, a potential avian flu epidemic can be averted. Avian influenza is now entrenched in Asia, with sporadic human infections resulting from either direct contact with infected birds or limited human-to-human transmission. Globalization and seasonal avian migration patterns have resulted in the disease spreading rapidly to other parts of the world.

The device comprises a unique platform developed by IBN that uses magnetic force to manipulate individual droplets containing silica-coated magnetic particles.

"The novelty of our method lies in the way that the droplet itself becomes a pump, valve, mixer, solid-phase extractor and real-time thermocycler. Complex biochemical tasks can thus be processed in a fashion similar to that of a traditional biological laboratory on a miniature scale," explained Dr Pipper.

The all-in-one droplet-based device is superior to commercially available solutions as it integrates the entire workflow of viral RNA isolation, purification, preconcentration, and detection.

Tests have shown that IBN's platform is as sensitive as, and around 10 times faster than available tests, yet it could potentially be 40 to 100 times cheaper.
IMCB co-author, Masafumi Inoue, is also the leading inventor for the Avian Flu (H5N1) detection kit that is currently being used in hospitals.

He adds that, "We had been developing the H5N1 detection kits and thus accumulated technical knowledge like primers and cycling conditions for the PCR assay. We are very pleased to see that these techniques were an advantage in improving the development of the new platform."

GIS co-author, Dr Lisa Ng, who was a co-inventor in another Avian Flu (H5N1) detection kit using GIS' proprietary nucleic acid diagnostic primers, played a role in the initial designs of the PCR and Primers assays in this project.

"We have a long journey ahead of us in our battle against infectious diseases, and the current avian influenza outbreaks caused by influenza A (H5N1) underscore the importance of improving our preparedness for the next emerging or re-emerging infectious agent." said Dr Ng.

Asked about the collaborations with other institutes, Professor Jackie Ying, Executive Director of IBN affirmed that "IBN is delighted that Dr

Juergen Pipper has initiated this multidisciplinary collaboration with our A*STAR sister institutes at the Biopolis. We are also pleased that two of our Youth Research Program attachment students have made substantial contribution to this project and are co-authors to this publication."

The unique lap-on-a-chip system developed by IBN can also be adapted for other infectious diseases such as SARS, HIV and hepatitis B, by extracting nucleic acids from other body fluids such as blood, urine or saliva.

"An increasing number of magnetic particle-based biochemical kits are commercially available to process cells, RNA, DNA and proteins. We envision that our droplet-based system will be an attractive diagnostic platform, especially for decentralized environmental, biological or medical testing," said Dr Pipper.

Source: Agency for Science, Technology and Research (A*STAR), Singapore